Dear spokesperson,

The Workshop on the Intermediate Neutrino Program (WINP) will be held at Brookhaven National Laboratory on February 4–6, 2015. The workshop organizers request that you fill out the enclosed template for describing your experimental plans by January 12, 2015 at 17:00 EST. These templates will be posted on the public WINP website and are intended to facilitate discussion on the best opportunities for neutrino experiments or R&D that can be accomplished in the intermediate time period (~5–10 years) at reasonable cost. Working group convenors may need input from you on an earlier time scale.

Steve Kettell
For the Organizing Committee

1. Name of Experiment/Project/Collaboration:

   CENNS: Coherent Elastic Neutrino Nucleus Scattering

2. Physics Goals

   The primary physics goal of the CENNS experiment is to discover the coherent elastic neutrino nucleus scattering (CENNS). The CENNS collaboration is proposing to use pion-decay at rest low energy neutrino source. The goal of the measurement uncertainty of the CENNS cross-section is about 10%.

3. Expected location of the experiment/project:

   The preferred location of the experiment is at the Fermilab BNB off-axis area. However the collaboration is open to the other locations such as SNS at Oak Ridge or MLF at J-PARK.

4. Neutrino source:

   Pion decay-at-rest neutrino source (BNB, SNS, MLF)

5. Primary detector technology:

   The detector technology is a single phase liquid argon scintillation detector. This detector technology is appropriate for the CENNS measurement owing to the fast detector response and pulse shape discrimination of particle interaction types. The detector technology is already well developed in dark matter physics community. CENNS collaboration is proposing to use the existing MiniCLEAN dark matter detect after the detector's dark matter search mission completed in 2017.

6. Short description of the detector

   The MiniCLEAN dark matter detector is utilizes 500 kg of liquid argon. The detector uses 92 sensitive photodetectors to look for flashes of light from the particles hitting the liquid.

The central detector is composed of three major elements, an Inner Vessel (IV) that contains the liquid cryogen, an array of optical cassettes that are inserted into the IV and define the inner target region, and an Outer Vessel (OV) that provides secondary containment and the necessary thermal insulation of the inner cryostat.

7. List key publications and/or archive entries describing the project/experiment.

   Phys. Rev. D 89, 072004 (2013) : arXiv:1311.5958

8. Collaboration

   a. Institution list

      Fermi National Accelerator Laboratory
      Indiana University
      University of Houston
      Los Alamos National Laboratory
      Virginia Tech
      North Carolina State University
      Duke University
      Pacific Northwestern National Laboratory

   b. Number of present collaborators : 20

   c. Number of collaborators needed : 50

9. R&D

   a. List the topics that will be investigated and that have been completed
      a1. The beam induced neutron flux and spectrum were measured at BNB in 2012.
      a2. The shielding study of the high energy neutrons need to be investigated.
      a3. The neutron interactions in the liquid argon detector need to be understood.

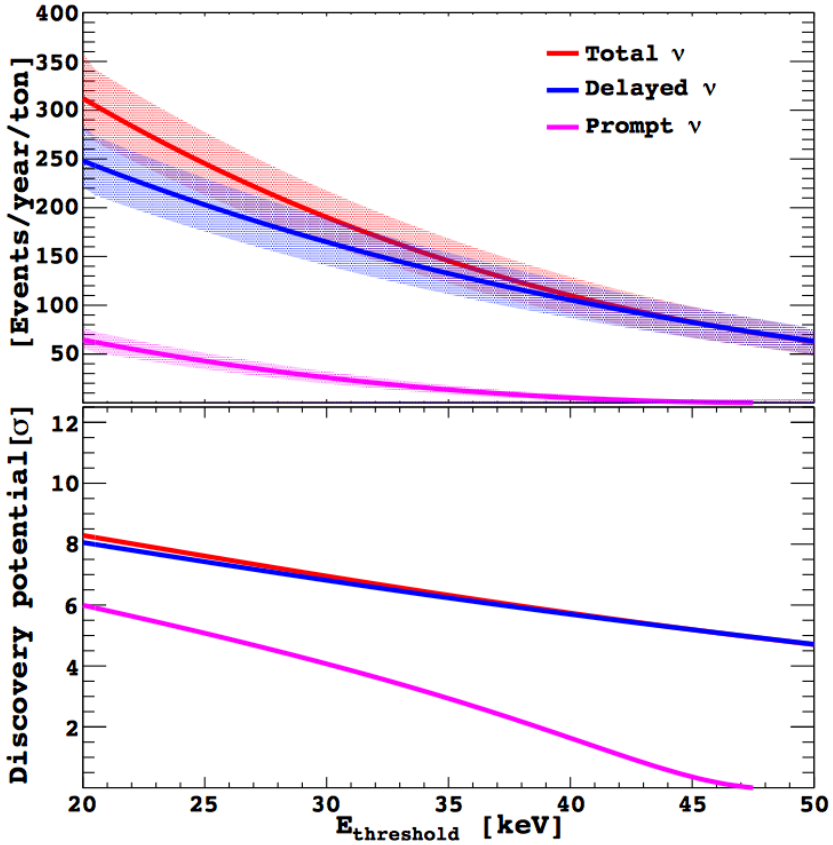
   b. Which of these are crucial to the experiment.
      The ability of shielding of the high energy neutron is the most crucial for the success of the experiment.

   c. Time line

      2015: Neutron shielding study at Fermilab BNB potential experiment site
      2016: High energy neutron interaction study using CENNS-10 detector

10. Primary physics goal expected results/sensitivity:

Discovery potential of the CENNS



CENNS discovery potential at Fermilab BNB. The signal event rates per ton detector after one-year operation as a function of detector energy threshold (top plot) and the discovery potential in σ (bottom plot). A flat detection efficiency of 50% over the energy range is assumed. The error bands on the top plot are 1 sigma quadratic-sum errors of statistical and systematic errors.

List the sources of systematic uncertainties

	Uncertainty
Neutrino flux	9%
Leff of LAr	7.5%
High energy neutrinos	<1%
Beam-induced neutrons	<1%
Cosmogenic neutrons	<1%
^{39}Ar and gammas	<0.5%
Radiogenic backgrounds	<1%
Total uncertainty	**12%**

11. Experimental requirements

The CENNS experiment requires low energy neutrino source (<50MeV) with low enough neutron fluxes. The intensity of the neutrino source maybe above $5x10^5$ neutrinos per second at 20m away from the target.

12. Expected Experiment/Project time line

a. Design and development : 2015 — 2016
b. Construction and Installation : 2017
c. First data : 2018
d. End of data taking : 2020
e. Final results: 2020

13. Estimated cost range

a. US contribution to the experiment/project: $2M
b. International contribution to the experiment/project: N/A
c. Operations cost: $1M

14. The Future

The purpose of the first phase CENNS experiment is to discover the CENNS with better than 5-sigma of sensitivity. CENNS is a large and well-predicted cross-section in the Standard Model Therefore, if discovered at its predicted rate, the CENNS process can become a powerful tool for future neutrino oscillation experiments. One can imagine compact, short-baseline oscillation measurements, where the oscillation length is comparable to the size of the detector. In precision searches for active neutrino disappearance, high statistics and very low systematic uncertainties could be attained. Conversely, any measured deviation of the CENNS cross-section from the robust SM prediction is an indication of the beyond-SM physics. CENNS interactions by solar and atmospheric neutrinos are irreducible backgrounds of the next generation dark matter experiments. Additionally, the analogous coherent scattering of WIMPs from the nucleus is the signal used in most direct searches for Dark Matter. Thus, understanding CENNS interactions are an invaluable input to future dark matter search experiments.